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Sent: Tuesday, November 25, 2003 4:22 PM
To: Gibson, Randy
Subject: Translation of EP 803,717 (Serial No. 10/030831)

Please find attached an electronic copy of the above-referenced translation. Your original request form, foreign language document and a hard copy of the translation will be returned to you via your EIC courier. Any feedback you wish to provide with respect to this translation or any provided by this office will be appreciated.

803717.ep.doc

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PTO 04-0641

CY=EP DATE=19971029 KIND=A1
PN=803,717

AUTONOMOUS ONE-PIECE WEIGHING PLATFORM
[TABLIER PESEUR MONOBLOC AUTONOME]

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UNITED STATES PATENT AND TRADEMARK OFFICE
Washington, D.C. NOVEMBER 2003

Translated by: FLS, Inc.

PUBLICATION COUNTRY	(10): EP
DOCUMENT NUMBER	(11): 0,803,717
DOCUMENT KIND	(12): A1
PUBLICATION DATE	(43): 19971029
PUBLICATION DATE	(45):
APPLICATION NUMBER	(21): 97490896.3
APPLICATION DATE	(22): 19970422
ADDITION TO	(61):
INTERNATIONAL CLASSIFICATION	(51): G01G 19/08
DOMESTIC CLASSIFICATION	(52):
PRIORITY COUNTRY	(33):
PRIORITY NUMBER	(31):
PRIORITY DATE	(32):
PRIORITY COUNTRY	(33):
PRIORITY NUMBER	(31):
PRIORITY DATE	(32):
PRIORITY DATE	(32):
DESIGNATED CONTRACTING STATES	(84): BE DE ES FR GB IT NL

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TITLE	(54): Autonomous one-piece weighing platform
FOREIGN TITLE	(54A): Tablier peseur monobloc autonome

(54) AUTONOMOUS ONE-PIECE WEIGHING PLATFORM /1*

(57) Abstract

The invention pertains to a one-piece weighing platform (1) that includes essentially some forks (2), some connection arms (3,4), some sensors (7) inserted between the said forks, and a connection box (8) that contains an analog/digital conversion unit and a micro-controller that interprets the measurements and transmits the results to a weight display unit (9).

The assembly unit, according to the invention, is characterized essentially in that:

- The A/N conversion unit is made by means of a multiple path converter that takes the measurements of the various sensors (7);
- The results of the measurements are sent to the weight display unit (9) by an infrared linkage of the transmitter/receiver type (13,14).

Description /2

The invention pertains to a one-piece weighing platform of the kind that includes some forks, some connection arms that connect the said forks, other connection arms attached in sliding manner to some roller tracks that belong to two uprights, some sensors, generally with a strain gauge, inserted between the said two series of connection arms, a connection box that is made as one piece with the mobile platform, which interprets the measurements and sends the results to a weight display unit that is integrated with the support to which the said uprights are connected.

* Number in the margin indicates pagination in the foreign text.

The known platforms of the kind in question, which are generally secured, through the intermediary of their uprights, either to a fixed wall, or to a mobile transport device (fork lift truck, stacking machine) generally includes:

- An analogue connection box that uses, for the adjustment of the angles, an empirical method that implements devices of the electric potentiometer kind, which consists in placing successively in the four corners of the load receiving part, a weight that represents generally one-third of the total load, and in achieving equilibrium of the sensors, sensor by sensor, thanks to the potentiometers, and of working in this way by iteration until obtaining perfect equilibrium: this method is of long duration (several hours as a function of the load), mainly because of problems related to the transfer of loads;
- A box-support link by cable, since we are at the analogue output, with the disadvantages caused by this kind of connection that is achieved between moving parts and fixed parts;
- A power supply of the box from a battery that is located on the fixed part of the assembly unit.

Such devices lack performance quality and flexibility, especially with respect to configuring the system from the analogue box.

The invention therefore aims to produce a one-piece weighing platform that eliminates these various disadvantages and that is characterized in that it essentially includes:

- A connection box with digital processing that performs the simultaneous addition of the measurements of the sensors, thereby eliminating the problems related to load transfers and simplifying the method by placing the load only one time in the four corners (a much more rapid adjustment).
- A fixed box-support for the transmitter/receiver with infrared directional beam since the data are encoded digitally (measurement of the weight, voltage of the battery);
- An interchangeable battery drawer, integrated with the platform, which provides power for the sensors, the box and the infrared transmitter;
- A micro-controller, which belongs to the box, which controls the measurements (based on the adjustment algorithm of the angles that has been calculated and memorized), storage of the various parameters, the measurement mode, the configuration mode of the system, and so forth.

The characteristics and the advantages of the invention will be more clearly evident from reading the detailed description that follows of at least one preferred mode of implementation of the

latter given as a non-limiting example and shown in the attached drawings. In these drawings:

- Figure 1 is a perspective view of a weighing platform installed on a fork lift truck;
- Figure 2 is a block diagram of the components and functions of the connection box.

The one-piece weighing platform (1) shown in the figures includes some forks (2), some attachment arms (3) that connect the said forks, some attachment arms (4) connected in sliding manner to some roller tracks (5) that belong to two upright posts (6), some sensors (7), generally with a strain gauge, inserted between the said attachment arms (3) and (4), a connection box (8), which is integrated with the mobile platform (3,4), which interprets the measurements and sends the results to a weight display unit (9) integrated with the support (10) to which the uprights (6) are secured.

The box (8) includes a multiple path analog/digital conversion unit (11) capable of simultaneously processing the measurements coming from the various sensors (7), and a micro-controller (12) capable of automatically making the adjustments of the angles, of configuring the functioning of the module, of averaging the converted values and of storing the various operational parameters.

The connection between the said connection box (8) and the uprights (6) is effected by a transmitter (13) / receiver (14), which has an infrared directional beam, which transmits to the weight display unit (9) the numerical data coming from the said box (8).

The connection box (8) can be used even in the case of a single sensor.

The mobile platform (3,4) can include an interchangeable battery drawer (15) capable of powering the sensors (7), the box (8) and the infrared transmitter (13).

The transmitter (13) is, for example, secured to the connection arm (4) and the receiver (14) to the base of the upright (6), which are aligned with one another.

The signal that gives the voltage of the rechargeable battery (15) is connected to the connection box (8) that transmits the said digitized signal to the weight display unit (9).

The box includes in addition, upstream from the converter (11), for each sensor (7), an amplification module (16) preceded by a passive low-pass filter, which has a cut-off frequency of 20 Hz, and followed by a second order active filter, centered at 5 Hz.

The filter (11) includes internally a digital low-pass filter with programmable cut-off frequency. /3

The micro-controller (12) is combined:

- With a module (17) for storage of parameters of the EEPROM type;

- With a module (18) of functional configuration of the assembly unit, which includes a push button for taking measurements of the sensor values during adjustment of the angles, switches that can select the operational mode and some display LEDs combined with the said switches;
- With an RS 232 output card (19).

The transmitter (13) is secured to the platform (3,4) through the intermediary of an arm (21). The receiver (14) - display unit (9) connection is accomplished via cable (22).

Adjustment of the angles is done simply by applying successively one-third of the maximal range to each of the four angles and by validating, with the push button of the module (18), the simultaneous measurement readings of the four sensors (by means of the multiple channel A/N converter) and their instantaneous memorization.

Once the survey of the angles is done, the micro-controller (12) calculates automatically the adjustment algorithm (which takes into account the load transfers) and stores their parameters. This algorithm is then applied automatically to each calculation of the signal average.

The micro-controller assures processing and shaping of the measurements.

It is used to initialize the converter by programming in particular its cut-off frequency and to recover the result of the conversion of the 4 channels.

- Calculates the average (case of several sensors) of the converted values by taking into account adjustment of the angles;
- Sends the result of the average in RS 232 format;
- Calculates the adjustment algorithm of the angles with storage in the EEPROM memory;
- Configures functioning of the module;
- Monitors functioning of the box with sending of possible error messages; with, in particular, monitoring of the supply voltage and the values stored in the memory.

The operating modes of the module (18) are, for example, the following:

- Measurement mode;
- Configuration mode (acquisition of the number of sensors);
- Mode of semi-automatic adjustment of the angles (calculation of the algorithm parameters).

All the parameters of configuration and calibration of the platform are sent to the weight display unit (9) integrated with the truck (20) for example.

As soon as the battery no longer has sufficient charge to prevent any reading error the box blocks the measurements until it is replaced.

The battery (15) is used to provide power for the power supply module (23) of the sensors and the power supply module (24) of the electronics (reference voltage with ratio meter correction).

The output (19)-display unit (9) link can be effected by cable (25).

Of course the invention is not limited to the implementation modes described here and shown in the figures for which one could provide other variants, in particular in:

- The number and type of sensors;
- The type of connection between the box and the display unit;
- The characteristics of the modules (amplifiers, converter, micro-controller, storage module) that are included in the composition of the box without thereby departing from the scope of the invention.

CLAIMS

1. One-piece weighing platform (1) of the kind that includes some forks (2), some

Attachment arms (3) that connect the said forks, some attachment arms (4) connected in sliding manner to some roller tracks (5) that are affixed to two uprights (6), some sensors (7), generally with a strain gauge, inserted between the said attachment arms (3) and (4), a connection box (8) integrated with the mobile platform (3,4), combined with an analog/digital conversion unit (11) and a micro-controller (12) that interprets the measurements and transmits the results to a weight display unit (9) integrated with the support (10) to which the uprights (6) are connected; characterized in that the analog/digital conversion unit (11) is made by means of a multiple path converter, whose number of paths or channels corresponds to the number of sensors inserted between the attachment arms (3) and (4), capable of measuring simultaneously and of storing the various values of charge given by the said sensors; in that the micro-controller automatically carries out the adjustment of the angles, configures the operation of the module, averages the converted values and stores the various operating parameters and in that the connection between the connection box (8), integrated with the mobile platform (3,4), and the weight display unit (9) integrated with the fixed uprights (6), is effected by means of a transmitter/receiver (13, 14), with

infrared directional beam, which transmits the digital data that pertains in particular to the weight measurement results.

2. Weighing platform, according to Claim 1, characterized in that /4 the box (8) includes, upstream from the A/N converter (11), for each sensor (7), an amplification module (16) preceded by a passive low-pass filter, which has a cut-off frequency of 20 Hz, and followed by an active filter of the second order centered at 5 Hz.

3. Weighing platform, according to Claim 1, characterized in that the A/N converter (11) includes internally a low-pass digital filter with programmable cut-off frequency.

4. Weighing platform, according to Claim 1, characterized in that the micro-controller (12) is combined with module (17) for storage of the parameters of the EEPROM type.

5. Weighing platform, according to Claim 1, characterized in that the micro-controller (12) is combined with module (18) for configuration of operation of the assembly unit, which includes a push button for taking readings of the sensor values during adjustment of the angles, some switches capable of selecting the operating mode and some display LEDs combined with the said switches.

6. Weighing platform according to Claim 1 characterized in that the micro-controller (12) is combined with an RS 232 output card (19).

7. Weighing platform according to Claim 1 characterized in that the mobile platform (3,4) includes an interchangeable battery drawer (15) capable of supplying power to the sensors (7), the box (8) and the transmitter (13).

8. Weighing platform according to Claim 7 characterized in that the signal that yields the voltage of the rechargeable battery (15) is connected to the box that transmits the said digitized signal to the display unit (9).

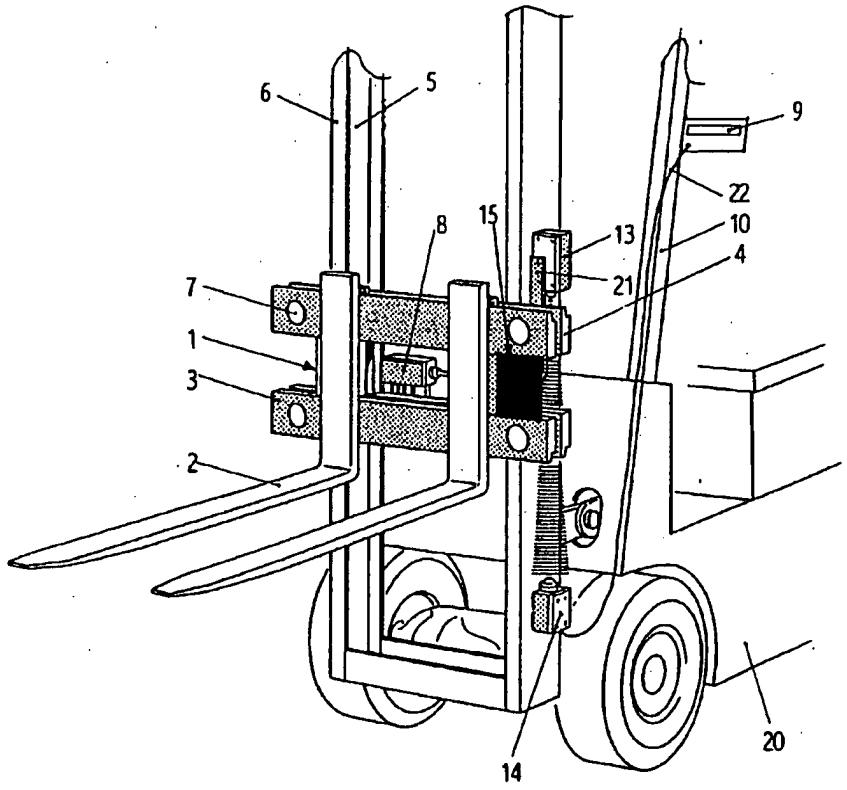

FIG.1

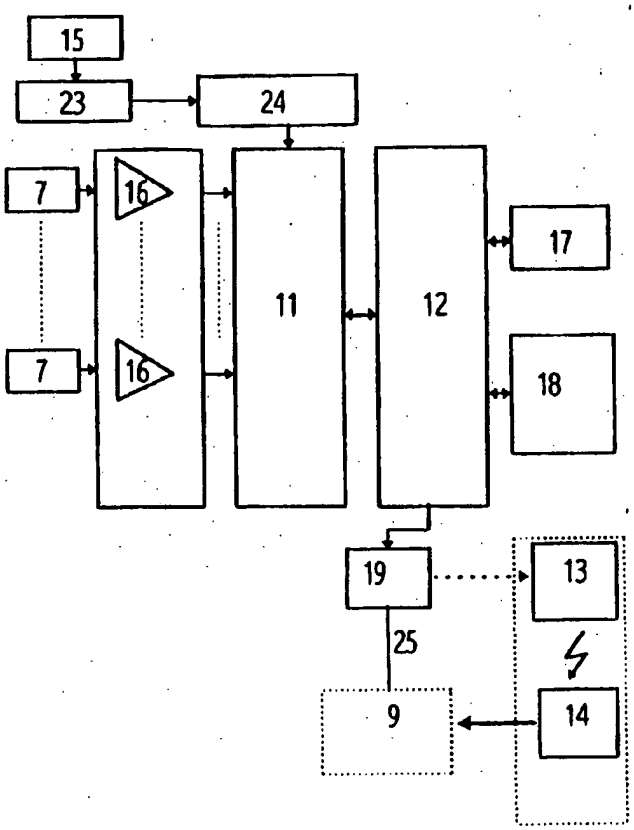

FIG.2